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LITTLELEAF DISEASE ON THE TALLADEGA NF, ALABAMA
DETECTION AND EVALUATION

by

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Abstract

Very little (2% overall) littleleaf disease was found on the Talladega NF during a survey of 49 stands on the 3 Ranger Districts. The greatest incidence of disease encountered in a single stand was 19 percent. In this (as well as some others) old southern pine beetle damage was also present and seemed to occur concurrently mostly on knolls or ridgetops. Few stands had more than 2 or 3 percent disease. Estimates of disease hazard by soil series were made and these were then used to evaluate mapped soil associations. Littleleaf does not appear to be of major concern for management of shortleaf pine on the Talladega NF. However, areas of high hazard soil exist and, where encountered, appropriate management measures should be implemented to reduce losses to the disease.

INTRODUCTION

Littleleaf disease of shortleaf pine is a serious root disease found in the Piedmont region of the South. Loblolly pine is also occasionally affected but to a lesser degree. Littleleaf is caused by a complex of factors including the soil-borne fungus Phytophthora cinnamomi Rands, soil factors (including erosion, poor internal soil drainage, low soil nitrogen), soil nematodes, and soil fungi in the genus Pythium.

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Symptoms are first expressed when the feeder root system becomes sufficiently damaged that nutrient supply to the crown is affected. Trees begin looking sickly, malnourished and exhibit a slight yellowing of the foliage. Current years needles tend to be shorter than normal and shoot growth is reduced. Progressive annual shortening of shoots and needles results in a tufting of foliage at the ends of branches. Dieback of twigs and branches eventually sets in. Heavy distress cone crops are often produced. Eventually trees die.

Trees younger than 20 years old are rarely affected and infected trees 20-50 years old may die in as little as 3 years or may live in a poor condition for many years. Height and diameter growth are severely reduced. Littleleaf disease is difficult to identify correctly and trees on poor infertile sites or affected by other pathogens may often express similar symptoms.

Since littleleaf disease is so closely associated with soil type a hazard rating system using soil characteristics has been developed (Campbell and Copeland 1954). This system, with modifications can be used to estimate disease hazard from soil series descriptions.

Most of the early work on littleleaf was summarized by Campbell and Copeland (1954). They estimated that littleleaf disease was found on 35 percent of the commercial shortleaf pine area east of the Mississippi River (about 15 million acres). On about 33 percent of the area (5 million acres) the disease was serious enough to interfere with forest management. Hepting (1949) applied South Carolina survey data to the entire littleleaf area of the South and estimated an annual stumpage loss of $5,000,000. Campbell and Copeland estimated from their review of surveys that annual mortality of dominant and codominant trees on severe littleleaf areas was approximately 3 to 5 percent. More recently an estimate of affected acres was made using published forest inventory figures for southern states and Campbell and Copeland's range map for the disease (Mistretta 1982). Acres of shortleaf pine affected by the disease were estimated to be 1,395,000.

A major portion of the littleleaf disease range falls in east central and northwest Alabama (figure 1). Concern about littleleaf in the two National Forests in this area, the Bankhead and the Talladega, resulted in a preliminary survey by Forest Pest Management in 1982 (Mistretta and Starkey 1982). Mortality of loblolly pine on the Bankhead NF was determined to be caused primarily by annosus root rot, while the small number of stands observed on the Talladega NF (Shoal Creek RD) with littleleaf-like symptoms were not confirmed as littleleaf disease. Further work resulted in a hazard rating of the Bankhead NF for annosus root rot (Mistretta, Starkey, and Covington 1983) but the extent and severity of littleaf disease on the three districts of the Talladega NF remained unknown.

The purpose of this survey was to determine the presence, extent, and severity of littleleaf disease on the Talladega NF, and to provide the Forest staff with a soil hazard classification and management recommendations.

METHODS

Available soils maps and soil series descriptions were obtained for the three Ranger Districts (RD) comprising the Talladega NF. For the Shoal Creek RD and the Talladega RD only SCS (USDA, Soil Conservation Service) County soil surveys were available. County surveys covering the Shoal Creek RD were Calhoun, Clay and Cleburne; covering the Talladega RD were Cleburne and Talladega. For the Oakmulgee RD a Soil Management Report (1983) with maps produced by the USDA-Forest Service and individual contractors was obtained. Soil series descriptions and interpretation records were obtained from the SCS for each soil series, and an estimate of hazard from littleleaf disease was made based on soil characteristics described by Campbell and Copeland (1954). For further explanation of this procedure see appendix 1. A hazard estimate was made for each soil series in each county even though all are not represented on Forest Service land. Since most soil mapping units were associations or complexes, the ratings for individual series (making up a map unit) were applied to the map units (based on their prevalence as stated in the map unit description). Thus a soil association with 70 percent of a high hazard series and 30 percent of a low hazard series is 70 percent high hazard.

A survey was conducted on each district. Visits were made to randomly selected but accessible stands selected from a list generated from CISC (Continuous Inventory of Stand Conditions) with the following characteristics:

- Age: 20+ years

- Forest Types: 12 - shortleaf pine - oak
  32 - shortleaf pine

- Stand Conditions Classes:
  02 - damaged poletimber
  03 - damaged sawtimber
  04 - shortleaf - littleleaf disease
  05 - sparse poletimber
  06 - sparse sawtimber
  07 - low quality poletimber
  08 - low quality sawtimber
  09 - mature poletimber
  10 - mature sawtimber
  11 - immature poletimber
  12 - immature sawtimber

- Timber Land Classes: 500 - standard
  700 - marginal

A total of 30 stands were examined on the Shoal Creek RD, 9 on the Talladega RD and 10 on the Oakmulgee RD. Stands were surveyed by placing a transect through each stand and tallying 100 trees by symptom class (healthy, light, moderate, severe and dead due to littleleaf disease). Transects, as much as possible, sampled the site variations present in the stand and in larger stands were terminated after 100 trees had been

tallied. In small stands more than one transect was needed and sometimes less than 100 trees were tallied. In a few stands more than 100 trees were tallied (when only a short distance remained in a transect to finish at a stand boundary or some other identifiable feature).

RESULTS

Hazard Rating

A list of 115 soil series, characteristics and estimated hazard rating for littleleaf disease is found in appendix 2. No soil series wase rated as high hazard, 31 were rated as intermediate and 84 as low hazard (based on the system described in appendix 1). As described in appendix 1, our hazard estimates may be somewhat conservative since the erosion factor is always assumed to be slight. It should be remembered, however, that where erosion is moderate or severe, the hazard increases. In fact, when the moderate factor for erosion is used 6 soil series move from intermediate hazard to high hazard and 36 series change from low to intermediate hazard. These are so designated in appendix 2. The hazard of the soil map units are presented in table 1. Most mapping units are, unfortunately, soil associations or complexes comprised of 2 or more soil series. These are usually of different hazards, thus making hazard rating of the mapped soil units somewhat confusing and imprecise. This is due to the fact that soil mapping in the county soil surveys in forested areas is generally an order 3 survey. That is, a survey meant to provide information for management of large areas such as watersheds, several farms or perhaps a RD compartment(s). Obviously, this order of survey is not accurate enough to reflect soil hazard to littleleaf disease at the stand level.

The soil survey done on the Oakmulgee RD is an order 2 survey. That is, a survey meant to provide information about land areas the size of several agricultural fields. While this is more accurate and could possibly reflect the soil hazard to littleleaf disease at the stand level, mapping on the Oakmulgee RD also used many associations and complexes of soils which are not sufficiently uniform to accurately define disease hazard. Also, the topography (especially on the Shoal Creek and Talladega RD's) is highly dissected causing abrupt changes in soil in rather small areas. Therefore, the estimated hazard of soil units to littleleaf listed in table 1 should be viewed as a general guide to hazard only. A person knowledgeable of the soils in the area might (by taking into account topography, slope, aspect etc.) be able to make a better assessment of hazard at the stand level, but on-the-ground examination by a soil scientist would be required to make an accurate determination of hazard to littleleaf in any given stand.

It was similarly impossible to separate the surveyed stands according to soil hazard. Indeed, the selected stands fell within soil associations or complexes which included soils of varying hazards, and most of these were 70-90% comprised of low hazard soil series. The most commonly encountered map units are listed below:

Soil map Unit/Series		Hazard	County/Source
TTS	Tatum-Tallapoosa-Fruithurst Assoc.	80% Low	Cleburne
TFH	Tatum-Fruithurst Assoc.	70% Low	Cleburne
St or Ss	Stony rough land	Prob. Low	Calhoun
Mte	Madison-Tallapoosa-Tusquittee Assoc.	93% Low	Clay
ThE	Tallapoosa-Tatum Assoc.	100% Low	Talladega
TcD	Tatum-Chewacla Assoc.	86% Low	Talladega, Clay
TrE	Tatum-Tallapoosa-Riverview Assoc.	96% Low	Clay
ImB	Iredell-Mecklenburg Assoc.	77% Intermed.	Clay
3A, 3B	Smithdate-Luverne Complex	85% Low	Oakmulgee
2A	Luverne Complex	70% Low	Oakmulgee
2B	Luverne-Smithdale Complex	80% Low	Oakmulgee
55	Luverne-Boswell Complex	40% Low, 30% Intermed.	Oakmulgee
5	Troup-Harleston-Mantachie Assoc.	90% Low	Oakmulgee
63	Smithdale-Troup Complex	80% Low	Oakmulgee

(for more detail see Table 1.)

Stand Survey

Results of the 100-tree transects of sample stands are given in table 2. Overall, 2 percent of the trees observed were diseased (ie. exhibited littleleaf-like symptoms) and 39 percent of the stands examined had >1 percent disease. Differences between the RD's were not great, although the Talladega had a slightly higher percent of stands diseased and the Oakmulgee had a slightly higher percent of trees diseased. The greatest incidence of disease encountered in a single stand was 19 percent. In this (as well as other stands with relatively high disease incidence) old southern pine beetle damage was also present and both disease and beetle damage seemed to occur concurrently mostly on knolls. Trees were tallied as littleleaf only if no sign of beetle damage was present. One stand with disease incidence of 9 percent was on an old gravel pit and surrounding area which was severely eroded. Annosus root rot was not considered as a possible factor in these stands since most were not plantations and had never been thinned. In fact, only one stand had had any cutting and it was very fresh.

The shortleaf and shortleaf pine-oak forest types on the Oakmulgee and Talladega RD's are not extensive (1 percent and 2 percent respectively). On the Shoal Creek RD, however, they account for 21 percent of the acres. The number of stands, acres surveyed and per cent of the two forest types are given in table 3.

DISCUSSION

An overall disease incidence of 2 percent is rather low, indicating that littleleaf is probably not a major problem on the Talladega NF. This is somewhat less than that recorded by Hepting and Cruikshank (1950) in South Carolina (4.2 percent), or that reported by Campbell and Copeland (1954)

in 17 South Carolina counties and 1 Georgia county (13 percent) and in 10 western Alabama counties (20 percent).

The earliest reports of mature shortleaf pine dying in Alabama were from Walker, Tuscaloosa and Tallapoosa counties (Campbell and Copeland 1954). While these fall around the Talladega NF, only a very small margin of southern Tuscaloosa county actually contains Forest Service land (Oakmulgee RD). Roth also (1954) reported on disease spread plots which were established in Tallapoosa and Colbert counties. Although most of the Talladega NF falls within the range of littleleaf disease reported by Campbell and Copeland (1954) in figure 1, it appears that very little disease is present there. The disease is known to be associated with poorly drained soils and is especially likely if the soil has been eroded. Much of the Talladega NF is comprised of steep, rocky land which may have been cutover but was never put into crop production nor severly eroded. Also, the steepness of the land may result in sufficiently high runoff rates that even the soils with poor internal drainage may not remain wet enough to have severe littleleaf disease problems.

The hazard ratings provided should prove useful in the silvicultural examination process. When a compartment is prescribed, the soil map units on which the stand occurs can be looked up in Table 1 to obtain an overall estimate of the disease hazard. Detailed descriptions of the map units should also be studied in the SCS County soil surveys or in the Oakmulgee Soil Management Report. Specific soil series included in the map unit can then be further checked by studying their characteristics and individual disease hazards in appendix 2.

In spite of the scarcity of severe littleleaf disease, there are areas where severe littleaf may occur and District personnel should consider it a possibility anywhere symptomatic trees are encountered. Forest Pest Management may be contacted for assistance as necessary. When severely diseased areas are discovered, an effort should be made to identify the soil series on which it occurs. This will aid in substantiating the estimates of disease hazard listed in appendix 2. The possible association of southern pine beetle (SPB) infestations on littleleaf sites should also be considered. Known littleleaf areas should be treated as high hazard for SPB. Similarly, soils within SPB spots should be identified and littleleaf hazard estimated. A summary of management techniques for littleleaf disease may be found in appendix 3. These should be considered whenever littleleaf is found in order to reduce losses from the disease.

Figure 1. Counties generally falling in the littleleaf disease range of Campbell and Copeland (1954) and purchase units of the Talladega NF, AL.

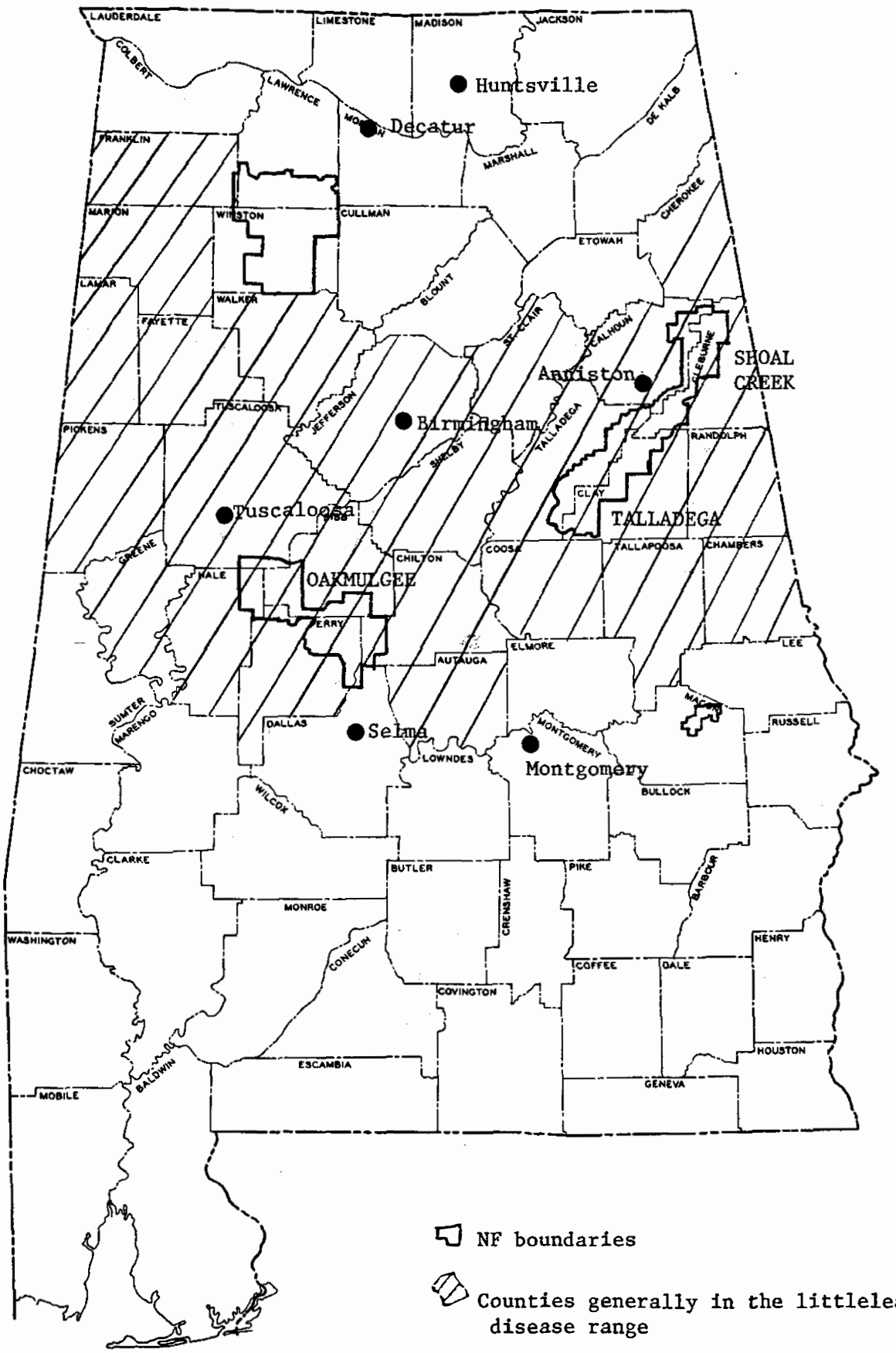

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Table 1. Soil map units and hazard to littleleaf disease for the Talladega NF, Alabama.

Soil Series: Map unit codes - description	% Hazard L [a]	I	H	Responsible Series	County or Source
Abell: Ab - Abell loam	100				CY [b]
Allen: Alc - Allen association	95				CY
AcC, AgB, AgC, AgD, AlB2, AlD2 - Allen soils	100				TA
AnE - Allen association	85				TA
Altavista: AaA, AaB2 - Altavista and Masada	100				CA
At - Altavista complex	32				CY
Angie: 2, 3, 4 - Angie soils		85			DA
Anniston: AbB3, AbC3, AbD3, AbE3 - Anniston soils	100				CA
AcA, AcB2, AcC2, AcD2, AcE2, AdC, AdE - Anniston and Allen soils	100				CA
AsB, AsD - Anniston soils	100				TA
Atkins: AkA - Atkins silt loam		100			CA
AsA - Atkins and Stendal soils		100			CA
Bama: 5, 6, 7, 8 - Bama soils	80				DA
Beason: Be - Beason silt loam		100			TA
Benndale: 9, 10 - Benndale soils	80				DA
Bigbee: 11, 12 - Bigbee soils	80				DA
Bodine: BhB, BhD, BmE - Bodine soils	100				TA
Bonneau: 13, 14 - Bonneau soils	80				DA
Boswell: (see Luverne - Boswell)					
Brantley: 15, 16, 17 - Brantley soils		85			DA
18 - Brantley - Lucy association	35	45		L = Lucy; I = Brantley	DA
Bremo: BrC - Bremo slaty silt loam	100				TA
Cahaba: (see Kalmia - Cahaba)					
Camp: (series changed to Shouns; see Shouns)	100				
Cane: CbB2, CbC2 - Cane soils	100				CA
CbB - Cane fine sandy loam	100				TA
Canton Bend: 19, 20, 21 - Canton Bend soils		80			DA
Captina: CcB, CcB2 - Captina soils	100				CA
Cecil: CeC - Cecil association	77				CY

Table 1. Soil map units and hazard to littleleaf disease for the Talladega NF, Alabama. (continued)

Soil Series: Map unit codes - description	% Hazard L	I	H	Responsible Series	County or Source
Cheaha: CES - Cheaha association	50				CB
Chenneby: (see Chewacla)					
Chewacla: Ch - Chewacla - Riverview complex	77				CY
Cc - Chewacla and Chenneby soils	85				TA
Choccolocco: Ch - Choccolocco silt loam	100				TA
Clarksville: CkB, CkC, CkC2, CkD, CkE - Clarksville soils	100				CA
ClC, ClD, ClF - Clarksville - Fullerton soils	100				CA
Clymer: ClE - Clymer association	92				CY
Cm - Clymer stony loam	100				TA
Conasauga: CnB2 - Conasauga silt loam		100			CA
Congaree: 22 - Congaree loam	85				DA
Cumberland: CoB2, CrB3, CrC3, CrD3 - Cumberland soils	100				CA
Davidson: DgD - Davidson - Gwinnett association	83				CY
Decatur: DcB3, DcC3, DcD3, DdA, DdB2, DdC2, DdD2 - Decatur and Cumberland soils	100				CA
DcA, DdB, DeC2, DeE3 - Decatur soils	100				TA
Demopolis: 23, 24 - Demopolis soils	80				DA
Dewey: DeC3, DeD3, DsB3, DsC3 - Dewey soils	100				CA
DlB, DmB2, DmC2, DmE3 - Dewey soils	100				TA
Dowellton: Do - Dowellton silt loam		100			TA
Dunning: DuA - Dunning silt loam		100			CA
Enders: EnB2, EnC2, EnD - Enders soils		100			CA
EmE - Enders - Montevallo association	28	45		L=Montevallo; I-Enders	TA
EtD - Enders - Townley - Montevallo complex	23	63		L=Montevallo; I=Enders and Townley	TA
Etowa: EtA, EtB2 - Etowah silt loam	100				CA
Fruithurst: (see Tatum)					
Fullerton: FcB, FcC2, FcD2, FcE, FlC3, FlD3, FlE3 - Fullerton soils	100				CA
FcB, FcC, FlD2 - Fullerton soils	100				TA

Table 1. Soil map units and hazard to littleleaf disease for the Talladega NF, Alabama. (Continued)

Soil Series: Map unit codes - description	% Hazard L	I	H	Responsible Series	County or Source
Gaylesville: 25, 26 - Gaylesville soils		80			DA
Georgeville: GeC2 - Georgeville and Tate soils	100				CA
Grasmere: Gr - Grasmere silty clay	100				TA
Greenville: 27 - Greenville loamy fine sand	85				DA
Grover: GrB, GrC - Grover sandy loam	100				CY
GvC - Grover association		84			CY
Guthrie: Gu - Guthrie silt loam		100			TA
Gwinnett: (see Davidson and Hiwassee)					CY
Harleston: (see Troup)					
Hector: (see other map units, Rock land - Hector etc.)					
Hiwassee: HcC - Hiwassee clay	100				CY
HGH - Hiwassee - Gwinnett association	85				CB
Holston: HoB2, HoC2 - Holston fine sandy loam	100				CA
HoB - Holston loam	100				CB
HAR - Holston - Allen association	50				CB
HoB, HsD - Holston fine sandy loam	100				TA
Houston: 29 - Houston clay		85			DA
Huntington: HuA - Huntington silt loam	100				CA
Iredell: ImB - Iredell - Mecklenburg association		77			CY
Jefferson: JeB2, JeC2, JeD2, JfB, JfD - Jefferson fine sandy loam	100				CA
Johnston: (see Mantachie)					
Kalmia: 44 - Kalmia - Cahaba association	85				CR
Kipling: 30, 31, 32 - Kipling loam		85			DA
Kirkville: (see Mantachie)					CR
Landisburg: (series renamed Stemley; see Stemley)					CA
Leadvale: Ld - Leadvale silt loam	100				TD
Lee: LcA, LeA - Lee silt loam	100				CA
Le - Lee silt loam	100				TA

Table 1. Soil map units and hazard to littleleaf disease for the Talladega NF, Alabama. (Continued)

Soil Series: Map unit codes - description	% Hazard L	I	H	Responsible Series	County or Source
Leeper: 33 - Leeper silty clay		80			DA
Lehew: LhC2, LhD2, LhE - Lehew - Montevallo soils	100				CA
Lindside: LkA - Lindside silt loam	100				CA
LlA - Lindside and Newark silt loam	100				CA
Linker: LnC2, Linker fine sandy loam	100				CA
Lobelville: LoA, LpA - Lobelville silt loam	100				CA
Lm - Lobelville loam	100				TD
Locust: LsA, LsB2, LsC2 - Locust fine sandy loam	100				CA
LoA, LoB, LtB - Locust soils	100				TD
Louisa: (see Madison)					
Lucedale: 34, 35, 36 - Lucedale fine sandy loam	85				DA
Lucy: 37, 38 - Lucy loamy fine sand	85				DA
Luverne: 55 - Luverne - Boswell complex	40	30		L=Luverne; I=Boswell	OR
2A - Luverne complex	70				OR
2B - Luverne - Smithdale complex	80				OR
39 - Luverne loamy sand	90				DA
40 - Luverne - Greenville association	71				DA
Madison: MaB, MdC - Madison soils	100				CY
MrD - Madison - Riverview association	96				CY
MtE - Madison - Tallapoosa - Tusquittee	93				CY
MaC - Madison gravelly sandy loam	100				CB
MAH - Madison association	70				CB
MLS - Madison - Louisa association	75				CB
Mantachie: 22 - Mantachie - Johnston association	75				OR
33 - Mantachie - Kirkville association	85				OR
41 - Mantachie loam	85				DA
Masada: MaB - Masada slaty loam	100				TA
Mashulaville: 42 - Mashulaville fine sandy loam		85			DA
McQueen: McA, McB - McQueen silt loam		100			TD

Table 1. Soil map units and hazard to littleleaf disease for the Talladega NF, Alabama.
(Continued)

Soil Series: Map unit codes - description	% Hazard L	I	H	Responsible Series	County or Source
Mecklenburg: MRR - Mecklenburg association		60			CB
Melvin: MaA - Melvin silt loam	100				CA
Me - Melvin silt loam	100				TA
Minter: 43, 44 - Minter soils		90			DA
Monongahela: MoA, MoB2 - Monongahela loam		100			CA
Montevallo: MsD,MsE,MtC3,MeD3 - Montevallo soils	100				CA
Muskingum: MuD, MuE - Muskingum stony fine sandy loam	100				CA
Newark: (see Lindside)					
Nolichucky: NcB2, NcC2 - Nolichucky gravelly fine sandy loam	100				CA
Ochlockonee: Oc - Ochlockonee loamy fine sand	100				CB
Oktibbeha: 45, 46 - Oktibbeha clay		80			DA
Philo: PhA, PlA, PkA - Philo and Stendal soils	100				CA
Pine Flat: 47 - Pine flat sandy loam	90				DA
Pope: PoA, PpA - Pope soils	100				CA
Purdy: PuA - Purdy silt loam		100			CA
Quitman: 49 - Quitman fine sandy loam	85				DA
Rarden: RaB2, RaC2, RdB2, RdC2, ReB3, ReC3 - Rarden soils		100			CA
RmC2 - Rarden - Mantevallo complex	50	50		% of each soil unknown	CA
Riverview: Re - Riverview silt loam	100				CY
Re - Riverview loam	100				CB
Rs - Riverview - State - Sylacauga complex	50	10		I=Sylacauga	CB
Roanoke: Ro - Roanoke silt loam		100			CY
Robertsville: RoA, RsA - Robertsville silt loam		100			CA
Saffell: 7A, 7B - Saffell - Smithdale complex	65				OR
50 - Saffell gravelly fine sandy loam	90				DA
Savannah: 51, 52, 53, 54 - Savannah fine sandy loam	85				DA
Sequatchie: ScA, ScB, ScB2, SeB2 - Sequatchie fine sandy loam	100				CA
Shouns (Camp): CaB - Camp silt loam	100				CA
Smithdale: 3A, 3B - Smithdale - Luverne complex	85				OR
4A, 4B - Smithdale, Luverne and Saffell soils	80				OR
6A - Smithdale association	80				OR
6B, 6C - Smithdale - Troup complex	80				OR

Table 1. Soil map units and hazard to littleleaf disease for the Talladega NF, Alabama. (Continued)

Soil Series: Map unit codes - description	% Hazard L	I	H	Responsible Series	County or Source
State: St - State fine sandy loam	100				CB
Stemley (Landisburg): LaB2, LaC2 - Landisburg cherty silt loam		100			CA
Stendal: (see Atkins and Philo)					
Sumter: 55, 56, 57 - Sumter silty clay	85				DA
Sylacauga: Sy - Sylacauga silt loam		100			CB
Sy - Sylacauga silt loam		100			TD
Tadlock: 58, 59, 60 - Tadlock fine sandy loam	85				DA
Taft: TaA - Taft silt loam	100				CA
Talladega: TdE - Talladega soils	100				CA
TaF - Talladega association	85				TD
Tallapoosa: TcD - Tallapoosa - Tatum complex	100				TD
ThE - Tallapoosa - Tatum association	80				TD
Tate: TeB2, TeC2, TgB3, TgC3 - Tate gravelly soils	100				CA
Tatum: TcD - Tatum - Chewacla association	86				CY
TrE - Tatum - Tallapoosa - Riverview association	96				CY
TfC - Tatum - Fruithurst complex	80				CB
TFH - Tatum - Fruithurst association	70				CB
TTS - Tatum - Tallapoosa - Fruithurst association	80				CB
TmB, TmC - Tatum slaty loam	100				TD
Toccoa: Ts - Toccoa sandy loam	100				CY
To - Toccoa loams	100				TD
Townley: TrB, TrC - Townley gravelly loam		100			TD
TsE - Townley association		82			TD
TtC2 - Townley - Tatum complex	36	54		L=Tatum; I=Townley	TD
Troup: 5 - Troup - Harleston - Mantachie association	90				OR
61 - Troup loamy fine sand	100				DA
62 - Troup - Kipling assocation	45	37		L=Troup; I=Kipling	DA
Tusquitee: (see Madison)					
Tyler: TyA - Tyler silt loam		100			CA

Table 1. Soil map units and hazard to littleleaf disease for the Talladega NF, Alabama. (Continued)

Soil Series: Map unit codes - description	% Hazard L	I	H	Responsible Series	County or Source
Vaiden: 65, 66 - Vaiden clay		90			DA
Waynesboro: WaD - Waynesboro fine sandy loam	100				CB
WhC - Waynesboro - Holston complex	70				CB
Wickham: WcA, WcB, WkB, WkC - Wickham loams	100				TD
67, 68 - Wickham fine sandy loam	85				DA
Other map units:					
Gullied land: Gl	variable				CA
Gullied land: 28	variable				DA
Mine wash: Me	variable				CA
Pits: 48	variable				DA
Rock land - Hector - Townley association, steep: Rhe	70	20		I=Townley; L=Rock land - Hector	TA
Slickens: Sk	variable			but probably often high	TA
Stony rough land, limestone: Sr	variable			but probably low	CA
Stony rough land, sandstone; Ss	variable			" " "	CA
Stony rough land, slate: St	variable			" " "	CA
Terrace Excarpments: Tr	variable				CA
Udifluvents, 4 to 25% slopes, channeled: 63	variable			but probably low to intermediate	DA

[a] L = Low, I = Intermediate, H = High; percentages may not equal 100. Unlisted series are minor components of many map units.

[b] CY = Clay, CA = Calhoun, CB = Cleburne, OR = Oakmulgee Soil Management Report, DA = Dallas, TA = Talladega

Table 2. Number and percent of stands and trees (total and littleleaf diseased) observed on the Talladega NF.

	Stands			Trees		
	No. Observed	No. [a/] Diseased	% Diseased	No. Observed	No. Diseased	% Diseased
Shoal Creek	30	12	40.0	2932	51	1.7
Talladega	9	4	44.4	723	12	1.7
Oakmulgee	10	3	30.0	933	32	3.4
Total	49	19	38.8	4588	95	2.1

[a/] Greater than 1% symptomatic trees.

Table 3. Number and percent of stands and acres (total and surveyed for littleleaf disease) of shortleaf and shortleaf pine-oak forest type on the Talladega NF.

	Total		Surveyed			
	No. Stands	No. Acres	No. Stands	No. Acres	% Stands	% Acres
Shoal Creek	600	20,843	30	1373	5.0	6.6
Talladega	44	1,565	9	207	20.5	13.2
Oakmulgee	30	1,095	10	272	33.3	24.8
Total	674	23,503	49	1852	7.3	7.9

Appendix 1. Soil hazard rating system for littleleaf disease applied to soil series on the Talladega NF, Alabama.

Soil hazard rating for littleleaf disease (Campbell and Copeland 1954) was applied to each soil series represented in the soil mapping units in the SCS County Soil Surveys or the Oakmulgee Soil Management Report. The system was applied to SCS soil series descriptions and interpretations as follows:

Soil character and class:	Value:
Erosion:	
Slight	40
Moderate	30
Severe	20
Rough gullied	10
Subsoil consistence (when moist):	
Very friable	32
Friable	24
Firm	16
Very firm	8
Extremely firm	0
Depth to zone of greatly reduced permeability:	
24 to 36 inches	15
18 to 23 inches	12
12 to 17 inches	9
6 to 11 inches	6
0 to 5 inches	3
Subsoil mottling:	
None	13
Slight	9
Moderate	5
Strong	1

This system was designed to be used in the field, however, all characteristics except erosion class can be obtained from the soil series description. A hazard scale was applied as follows:

Healthy (low hazard)	75+ points
Light to md. disease (intermediate)	51-74 points
Severe (high hazard)	<51 points

Since the erosion factor cannot be determined, the factor for slight erosion was used throughout. It must be remembered, however, that with more erosion the hazard of a soil would increase. Our hazard rating, therefore, may be somewhat conservative.

As an example, the Iredell series was rated as follows:

Erosion: slight	40
Subsoil consistency: very firm	8
Depth to reduced permeability: 6-11"	6
Subsoil mottling: moderate	5
	59

Hazard:
with slight erosion = Intermediate
with moderate or severe erosion = High

Ratings for all soil series represented are presented in appendix 2.

Appendix 2. Soil series characteristics and hazard to littleleaf disease on the Talladega NF, Alabama.

Soil Series	Subsurface Texture (below 6")	Drainage	Permeability	Subsoil Consistence	Depth to Reduced Permeability	Subsoil Mottling	Total Points	Hazard
Abell	SCL, CL[a]	MW[a]	M[a]	FR-FI[a] (20)	18-23" (12)	M[a] (5)	77	L (I)[b]
Allen	L	WD	M	FR (24)	24-36" (15)	SL-M (9)	88	L
Altavista	FSL, SCL	MW	M	FR (24)	12-17" (9)	M (5)	78	L (I)
Angie	VFSL, SICL	MW	S	FR-FI (20)	6-11" (6)	M (5)	71	I
Anniston	CL, C	WD	M	FR (24)	24-36" (15)	N (13)	92	L
Atkins	SCL,SIL,SICL	D	S-M	FR-FI (20)	6-11" (6)	ST (1)	67	I
Bama	FSL,SCL	WD	M	FR (24)	24-36" (15)	N (13)	92	L
Beason	SICL,SIC,SICL	SP	MS	FI (16)	6-11" (6)	ST (1)	63	I
Benndale	L, FSL	WD	M	FR (24)	24-36" (15)	SL (9)	88	L
Bibbee	LS, S	E	R	VFR (32)	24-36" (15)	N (13)	100	L
Bodine	CR-SICL,CR-VSICL	SE	MR	FR (24)	24-36" (15)	N (13)	92	L
Bonneau	LS,SL,SCL	WD	M	FR (24)	24-36" (15)	SL (9)	88	L
Boswell	SCL,C	MW	VS	FI (16)	0-5" (3)	ST (1)	60	I (H)
Brantley	C,CL	WD	S	FI-FR (18)	6-11" (6)	SL (9)	73	I
Bremo	GR-SIL	SE	MR-M	FR (24)	24-36" (15)	SL (9)	88	L
Cahaba	SL,SCL	WD	M	FR (24)	6-11" (6)	N (13)	83	L
Camp (see Shouns)								
Cane	SIL	MW	M-S	FI (16)	24-36" (15)	SL (9)	80	L
Canton Bend	SICL,CL	WD	S	FI-FR (18)	6-11" (6)	M (5)	69	I
Captina	SIL,SICL	MW	S	FI (16)	24-36" (15)	M (5)	76	L (I)
Cecil	SCL,C,CL	WD	M	FR-FI (20)	24-36" (15)	N (13)	88	L

Appendix 2. Soil series characteristics and hazard to littleleaf disease on the Talladega NF, Alabama. (Continued)

Soil Series	Subsurface Texture (below 6")	Drainage	Permeability	Subsoil Consistence	Depth to Reduced Permeability	Subsoil Mottling	Total Points	Hazard
Cheaha	ST-SIL	WD	M	FR (24)	24-36" (15)	N (13)	92	L
Chenneby	SIL	SP	M	FR (24)	24-36" (15)	M-ST (3)	82	L (I)
Chewacla	SIL,L,SICL	SP	M	FR (24)	24-36" (15)	M (5)	84	L (I)
Choccolocco	SICL,SIL	WD	M	FR (24)	24-36" (15)	SL (9)	88	L
Clarksville	CRV-SICL,SIC	SE	M-R	FR-FI (20)	24-36" (15)	SL (9)	84	L (I)
Clymer	CN-L	W	MR	FR (24)	24-36" (15)	N (13)	92	L
Conasauga	SICL,SIC	MW	S	FI-FR (18)	0-5" (3)	ST (1)	62	I
Congaree	L	M-MW	M	FR (24)	24-36" (15)	N (13)	92	L
Cumberland	SICL,C	WD	M	FI (16)	24-26" (15)	N (13)	84	L (I)
Davidson	C,CL	WD	M	FI (16)	24-36" (15)	SL (9)	80	L (I)***
Decatur	SICL,C	WD	M	FI (16)	24-36" (15)	N (13)	84	L (I)
Demopolis	SICL	W	S	FR-XFI (16)	12-17" (9)	N (13)	78	L (I)
Dewey	C	WD	M	FI-VFI (12)	24-36" (15)	SL (9)	76	L (I)
Dowellton	SIL,SIC,C	P	S	FI-VFI (12)	12-17" (9)	M (5)	66	I
Dunning	SICL,SIC	P-VP	S	FI (16)	12-17" (9)	ST (1)	66	I
Enders	GR-L,FSL,SICL,SIC	WD	VS	FI (16)	6-11" (6)	SL (9)	71	I
Etowa	SIL,SICL	WD	M	FR-FI (20)	24-36" (15)	SL (9)	84	L (I)
Fruithurst	L	WD	M	FR (24)	24-36" (15)	N (13)	92	L
Fullerton	CR-SIL,SICL,C	WD	M	FI (16)	24-36" (15)	SL (9)	80	L (I)
Gaylesville	SICL,SIC	P-SP	S	FI (16)	0-5" (3)	ST (1)	60	I (H)

Appendix 2. Soil series characteristics and hazard to littleleaf disease on the Talladega NF, Alabama. (Continued)

Soil Series	Subsurface Texture (below 6")	Drainage	Permeability	Subsoil Consistence	Depth to Reduced Permeability	Subsoil Mottling	Total Points	Hazard
Georgeville	SIC,CL,SIL	WD	M	FI-FR (18)	24-36" (15)	N (13)	86	L
Grasmere	SIC,SICL,C	WD	M	FR-FI (20)	24-36" (15)	SL (9)	88	L
Greenville	SCL,SC	WD	M	FR (24)	24-36" (15)	N (13)	92	L
Grover	SL,SCL	WD	M	FR (24)	24-36" (15)	M (5)	84	L (I)
Guthrie	SIL,SICL	P	S	FR-VFI (16)	24-36" (15)	ST (1)	72	I
Gwinnett	SCL,C	WD	M	FI-FR (20)	24-36" (15)	N (13)	88	L
Harleston	L,SCL	MW	M	FR (24)	24-36" (15)	M (5)	84	L (I)
Hector	FSL	WD	MR	FR (24)	12-17" (9)	N (9)	92	L
Hiwassee	C,CL	WD	M	FI-FR (20)	24-36" (15)	SL (9)	84	L (I)
Holston	CL,L	WD	M	FR (24)	24-36" (15)	SL (9)	88	L
Houston	C	MW	S	FI-VFI (12)	0-5" (3)	SL (9)	64	I
Huntington	SIL	WD	M	FR-FI (20)	24-36" (15)	N (13)	88	L
Iredell	C,L	MW-SP	S	VFI (8)	6-11" (6)	M (5)	59	I (H)*
Jefferson	GR-L,GR-CL	WD	MR	FR (24)	24-36" (15)	N (13)	92	L
Johnston	MK-L,LFS,FSL	VPD	MR-R	FR (24)	24-36" (15)	N (13)	92	L
Kalmia	LS,SCL,LS	WD	M	FR (24)	12-17" (9)	SL (9)	82	L (I)
Kipling	SIC	SP	VS	FI (16)	0-5" (3)	ST (1)	60	I (H)
Kirkville	L,SL	MWD	M	FR (24)	24-36" (15)	M (5)	84	L (I)
Landisburg (see Stemley)								
Leadvale	SIL,SICL	MW	S-MS	FR-FI (20)	18-23" (12)	M (5)	77	L (I)
Lee	CR-SIL	PD	M	FR (24)	24-36" (15)	M (5)	84	L (I)

Appendix 2. Soil series characteristics and hazard to littleleaf disease on the Talladega NF, Alabama. (Continued)

Soil Series	Subsurface Texture (below 6")	Drainage	Permeability	Subsoil Consistence	Depth to Reduced Permeability	Subsoil Mottling	Total Points	Hazard
Leeper	SIC	SP	VS	FI (16)	6-11" (6)	M (5)	67	I
Lehew	CN-SL	W-E	MR-R	FR (24)	24-36" (15)	N (13)	92	L
Lindside	SIL,SICL	MW	M	FR-FI (20)	24-36" (15)	M (5)	80	L (I)
Linker	FSL,SCL	WD	M	FR (24)	24-36" (15)	SL (9)	88	L
Lobelville	CR-SIL	MWD	M	FR (24)	24-36" (15)	ST (1)	80	L (I)
Locust	CL,L	MWD	S	FR-FI (20)	24-36" (15)	M (5)	80	L (I)
Louisa	GR-L	W-SE	MR	FR (24)	12-17" (9)	N (13)	86	L **
Lucedale	L,SCL	WD	M	FR (24)	24-36" (15)	N (13)	92	L
Lucy	LS,SL,SCL	WD	MR-R	VFR (32)	24-36" (15)	N (13)	100	L
Luverne	C,CL,SCL	WD	MS	FI-FR (18)	6-11" (6)	N (13)	77	L (I)
Madison	C,CL	WD	M	FR (24)	24-36" (15)	N (13)	92	L **
Mantachie	FSL,L	SP	M	FR (24)	24-36" (15)	ST (1)	80	L (I)
Masada	FSL,CL	WD	M	FR-FI (20)	24-36" (15)	M (5)	80	L (I)
Mashulaville	L,CL	PD	S	VFI-FI (12)	24-36" (15)	ST (1)	68	I
McQueen	SIC,CL	WD	S	FI (16)	6-11" (6)	SL (9)	71	I
Mecklenburg	C,CL	WD	S	FI (16)	6-11" (6)	M (5)	67	I ***
Melvin	SIL	PD	M	FR (24)	24-36" (15)	ST (1)	80	L (I)
Minter	SICL,C,CL	PD	VS	FR-FI (20)	0-5" (3)	ST (1)	64	I
Monongahela	SIL,L	MW	M-S	FR-VFI (16)	18-23" (12)	M (5)	73	I
Montevallo	SH-SIL	WD	M	FR (24)	12-17" (9)	N (13)	86	L
Muskingum	SIL,CH-SIL	WD	M	FR (24)	24-36" (15)	N (13)	92	L

Appendix 2. Soil series characteristics and hazard to littleleaf disease on the Talladega NF, Alabama. (Continued)

Soil Series	Subsurface Texture (below 6")	Drainage	Permeability	Subsoil Consistence	Depth to Reduced Permeability	Subsoil Mottling	Total Points	Hazard
Newark	SL	SP	M	VF (32)	24-36" (15)	M (5)	92	L
Nolichucky	L,CL	WD	M	FR (24)	24-36" (15)	SL (9)	88	L
Ochlockonee	FSL,VFSL	WD	M	FR-VFR (28)	24-36" (15)	N (13)	96	L
Oktibbeha	C	MW	VS	VFI (8)	0-5" (3)	ST (1)	52	I (H)
Philo	SIL	MW	M-MS	FR-FI (20)	24-36" (15)	SL (9)	88	L
Pine Flat	SL,SCL	WD	MR	FR (24)	24-36" (15)	N (13)	92	L
Pope	FSL	WD	M-MR	VFR (32)	24-36" (15)	SL (9)	86	L
Purdy	SIL,SICL,SIC	P-VP	S-VS	FI (16)	6-11" (6)	ST (1)	63	I
Quitman	FSL,SCL	SP	M-MS	FR (24)	18-23" (12)	ST (1)	77	L (I)
Rarden	SICL,SIC	WD-MW	S	FI (16)	6-11" (6)	M (5)	67	I
Riverview	L,FSL	WD	M	FR (24)	24-36" (15)	N (13)	92	L
Roanoke	SICL,C	P	S	FI (16)	12-17" (9)	M (5)	68	I
Robertsville	SIL,SICL	PD	S-VS	FR-VFI (16)	18-23" (12)	M-ST (3)	71	I
Saffell	GR-SCL,FSL	WD	M	FR (24)	6-11" (6)	N (13)	83	L (I)
Savannah	SIL,L	MWD	M-MS	FR (24)	24-36" (15)	M-ST (3)	82	L (I)
Sequatchie	L,SL	WD	M	FR (24)	24-36" (15)	SL (9)	88	L
Shouns (Camp)	SIL,SICL	WD	M	FR-FI (20)	24-36" (15)	N (13)	88	L
Smithdale	SL,SCL,SL	WD	M	FR-VFR (30)	6-11" (6)	N (13)	89	L
State	SIL,L	WD	M	FR (24)	24-36" (15)	N (13)	92	L
Stemley (Landisburg)	CR-SIL,L	MW	M-S	FR-FI (20)	12-17" (9)	M (5)	74	I
Stendal	SL	SP	M	FR (24)	24-36" (15)	M (5)	84	L (I)
Sumter	C	WD	S	FR-FI (20)	24-36" (15)	SL (9)	84	L (I)

Appendix 2. Soil series characteristics and hazard to littleleaf disease on the Talladega NF, Alabama. (Continued)

Soil Series	Subsurface Texture (below 6")	Drainage	Permeability	Subsoil Consistence	Depth to Reduced Permeability	Subsoil Mottling	Total Points	Hazard
Sylacauga	SICL,L	SP	S	FR (24)	0-5" (3)	ST (1)	68	I
Tadlock	C	WD	M	FR (24)	24-36" (15)	N (13)	92	L
Taft	SIL	SPD	S	FR-FI (20)	24-36" (15)	ST (1)	76	L (I)
Talladega	CN-SIL,CL	WD	M	FR (20)	24-36" (15)	N (13)	88	L
Tallapoosa	SICL	WD	M	FR (24)	12-17" (9)	N (13)	86	L
Tate	CL,SCL	WD	M	FR (24)	6-11" (6)	N (13)	83	L (I)
Tatum	SIL,SICL,SIC	WD	M	FR (24)	6-11" (6)	N (13)	83	L (I)***
Toccoa	SL	WD	MR	VFR (32)	24-36" (15)	N (13)	100	L
Townley	SICL,SIL	WD	S	FR-FI (20)	6-11" (6)	M (5)	71	I
Troup	FS,LFS	WD	M-R	FR (24)	24-36" (15)	N (13)	92	L
Tusquitee	L,CL	WD	M	FR (24)	12-17" (9)	N (13)	86	L
Tyler	SIL,SICL,SIL	SP	S-VS	FI (24)	12-17" (9)	ST (1)	74	I
Vaiden	C	SP	VS	FI (16)	0-5" (3)	ST (1)	60	I (H)
Waynesboro	L,CL,C	WD	M	FR (24)	24-36" (15)	SL (9)	88	L
Wickham	SL,SCL	WD	M	FR (24)	6-11" (6)	M (5)	75	L (I)

* This soil has been rated as high hazard in South Carolina by the Asheville, NC Forest Pest Management Group.

** This soil was listed by Campbell and Copeland (1954) as being associated with intermediate levels of littleleaf disease.

*** This soil was listed by Campbell and Copeland (1954) as being associated with higher levels of littleleaf disease and often high hazard.

[a] See key to abbreviations on next page.

[b] Hazard ratings in parenthesis are given when the use of the moderate erosion factor results in a change in hazard.

Key to Abbreviations in Appendix 2.

Subsoil Consistence

FR = friable
FI = firm (VFI = hard)
V = very
X = extremely

Subsoil Mottling

N = none
SL = slight
M = moderate
ST = strong

Hazard

L = low
I = intermediate
H = high

Subsurface Texture Modifiers

CN	Channery
CR	Cherty
CRV	Very cherty
GR	Gravelly
MK	Mucky
SH	Shaly

Subsurface Texture

S	Sand
FS	Fine sand
VFS	Very fine sand
LS	Loamy sand
LFS	Loamy fine sand
LVFS	Loamy very fine sand
SL	Sandy loam
FSL	Fine sandy loam
VFSL	Very fine sandy loam
L	Loam
SIL	Silt loam
SI	Silt
SCL	Sandy clay loam
CL	Clay loam
SICL	Silty clay loam
SC	Sandy clay
SIC	Silty clay
C	Clay
VSI	Very silty

Drainage

E = excessive
SE = somewhat excessive
WD = well
MWD = moderately well
SP = somewhat poorly
P = poorly
VP = very poorly

Permeability

R = rapid
MR = moderately rapid
M = moderate
MS = moderatley slow
S = slow
VS = very slow

Appendix 3. Summary of management techniques for littleleaf disease.

The following guidelines will aid in reducing growth and mortality losses due to littleleaf disease on high hazard sites:

Areas for Regeneration:

1. Consider seed tree or shelterwood regeneration - when heavily infected stands must be eliminated and adequate numbers of disease-free trees are available, consider using a seed tree or shelterwood system to regenerate the stand. Using naturally selected, uninfected parent trees may confer some genetic resistance on the future stand.

2. Consider subsoiling - This practice will break up a hardpan and improve internal drainage of soil. This will, in turn, reduce littleleaf incidence. Only high value areas would be likely candidates for subsoiling.

3. Use species that are resistant or less susceptible - Avoid planting shortleaf pine on sites with a previous history of littleleaf disease or on known high hazard sites. Regenerate with seed or seedlings of improved loblolly pine from seed orchards or consider conversion to a non-host management type such as hardwoods.

Young Stands:

1. Consider fertilization - In high-value stands showing early symptoms of disease, fertilize with up to 250 pounds of inorganic nitrogen per acre.

2. Selectively thin - In adequately stocked stands (with basal area of at least 60 $ft.^2/ac$) with low levels of littleleaf affected trees (less than 25 percent of trees symptomatic), remove all obviously infected trees. If thinning will reduce the basal area below 30 $ft.^2/ac$ then consider regeneration. In adequately stocked stands with more than 25 percent of stems affected, consider regeneration.

Merchantable Stands:

1. Selectively thin if adequately stocked. The biggest single gain to be derived in thinning a merchantable stand is the removal of disease-weakened trees that have been associated with early bark beetle attacks.

Further information on littleleaf disease can be found in the following publications:

Anderson, R.L.; Mistretta, Paul A. Management strategies for reducing losses caused by fusiform rust, annosus root rot and littleleaf disease. Ag. Hdbk. No. 597. Washington, DC; U.S. Department of Agriculture, Forest Service and Cooperative State Research Service; 1982. 30 p.

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LITTLELEAF DISEASE ON THE TALLADEGA NF, ALABAMA
DETECTION AND EVALUATION

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